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Work with Vitis Rotundifolia

A Species of Muscadine Grapes

BY

H. P. STUCKEY

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H. P. STUCKEY, *Director,*
Experiment, Georgia.

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WORK WITH VITIS ROTUNDIFOLIA A SPECIES OF MUSCADINE GRAPES.

By H. P. Stuckey.

Vitis rotundifolia has become a very important species of grapes in Georgia as well as in other southern states. Work with this fruit was begun at the Georgia Experiment Station in 1909 and since that time a large mass of data has been accumulated. The present bulletin is intended largely as an introductory publication, dealing with the practical phases of the work, and giving some of the more outstanding points of the breeding investigations. A bulletin more technical in nature, dealing with the correlation of certain hereditary characters, and with the microspore development of this species of grapes, is planned to follow.

Classification.

The muscadine grapes embrace two species, the Vitis munsoniana, and the Vitis rotundifolia. The Vitis munsoniana species is found in this State only in the extreme southern border and will not be further discussed in this bulletin. The Vitis rotundifolia species, with which we are here interested, embraces the common Scuppernong, Thomas, James, Flowers, and other well known varieties of this species.

All of these varieties are sometimes erroneously called "Scuppernongs." Some go so far as to call all black fruiting varieties "black Scuppernongs." In reality, Scuppernong is a varietal name rather than a class name; and correctly applies only to the one light or amber colored fruiting variety, the Scuppernong, so commonly grown practically all over Georgia and in several other states of the South. When we have adopted the practice of designating each of the varietiess of this species by its proper name rather than calling all of them Scuppernongs, we will have done much towards clarifying their much tangled nomenclature.

Other Investigations.

Reimer[1] points out that in all the literature he has examined, the earliest recorded attempts to improve this grape were those of Mr. J. Van Buren of Clarkesville, Georgia, in 1868, Mr. John McRae of Camden, S. C., in 1877, and Dr. Peter Wylie of Chester, S. C. None of these efforts seemed to have met with any results. In more recent years, 1890 to 1900, Mr. T. V. Munson [2] of Dennison, Texas, did some extensive work in crossing Vitis rotundifolia with Vitis munsoniana, and introduced several new varieties from this work. Among them are LaSalle, San Jacinta, San Monta, Labama, and San Melaska, which are growing at this Station.

Newman [3] found that these grapes could be pruned without bleeding, i.e. the loss of sap, from October 20th to November 21st, but vines cut in pruning from December 19th, to April 20th, were followed by severe bleeding. He was the first to recommend 4-wire verticle trellising. Reimer and Detjen, [4] and Husmann and Dearing [5] show that most varieties of this class of grapes are self sterile and require the presence of staminate or male vines as pollinators for successful crops of fruit. They show, further, the inheritance of certain color characters in crosses made.

Detjen [6] found that Vitis rotundifolia would hybridize with munsoniana, vinifera, bourquiniana, labrusca, cardifolia and aestivalis species. He found, further, that most hybrids derived from Vitis rotundifolia and species of Euvitis were almost sterile.

SELF STERILITY.

As reported by other investigators we found that practically all varieties of this class of grapes are self sterile, that is, they are incapable of pollinating themselves. They produce pollen but the pollen is not viable and therefore not capable of fertilizing the flowers. Proof of such sterility was secured by three different methods. First, we bagged a number of flower clusters, before the blossoms opened, with cloth, and paper bags. In

[1] Bul. 201, N C. Exp. Sta.
[2] Foundations of American Grape Culture.
[3] Bul. 132, S. C. Exp. Sta.
[4] Bul. 209 and Tech. Bul 10, N. C. Exp. Sta.
[5] Bul. 273, B. P. I., U. S Dept. Agr.
[6] Tech. Buls. 17 and 18, N. C. Exp. Sta.

some, we introduced pollen from a male or staminate vine, while a number were allowed to remain without the introduction of pollen. Those flower clusters receiving pollen at the time the stigmas were receptive, set fruit, while those receiving no outside pollen failed to produce any grapes at all. Again, we made germination tests of the pollen in gelatin and sugar solutions in the laboratory and found that the pollen from the male vines germinated readily, while the pollen from the female or fruitful vines failed to germinate. A third test made was to place a bearing Flowers vine in the green house and force it into flower ahead of the male vines on the outside and thus seclude it from all grape pollen other than its own. This vine failed to set any fruit whatsoever until later in the season when pollen was secured from male vines on the outside and used for pollinating the flowers that were still receptive.

A STUDY OF MICROSPORE DEVELOPMENT.

During the last three years an effort has been made to determine the underlying causes of self sterility in this class of grapes through a study of the microspore development. The results of this work will be published later as a technical bulletin, but we may here mention that the pollen from the staminate vines develops in a normal way while that from the pistillate or fruitful vines develop in a normal way until the pollen grains are well formed, at which time there is a degeneration of the generative nuclei.

HOW TO DISTINGUISH THE MALE FROM THE FEMALE VINES.

Inexperienced growers sometimes find it difficult to distinguish between the male and the female vines. Thus far, the only positive distinction we are able to make is the difference between the flowers of the two vines. The female vines produce flowers with short, and usually recurved, stamens and well developed ovules. The male vines produce flowers with long, upright stamens, having large anthers, and with inconspicuous and aborted ovules. The females bear fruit, while the males bear no fruit at all.

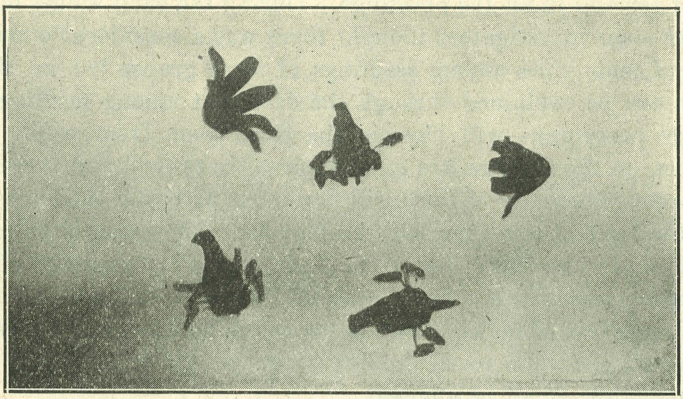


Fig. 1. Female flowers (enlarged).

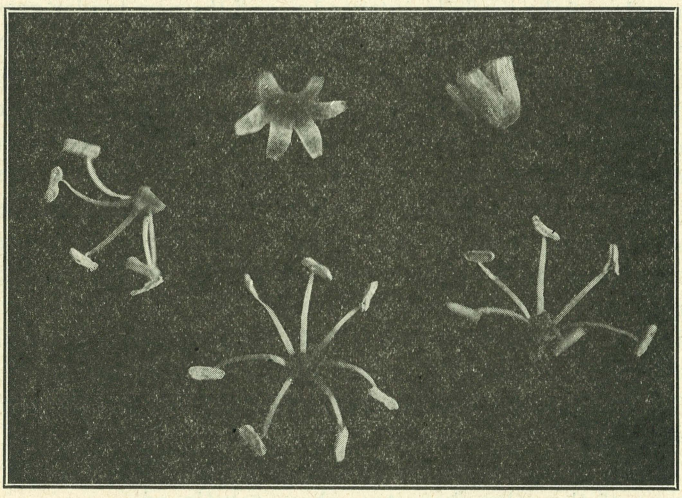


Fig. 2. Male flowers (enlarged).

SEXES IN SEEDLINGS.

Since this work was begun we have brought into bearing more than two thousand seedling vines resulting from the various crosses made. It is not necessary to give the tabulated results of the several plantings made as regards the number of each sex, since our work corresponds with that of other investigators in showing that there are approximately one half males and one

half females in all the plantings. During the early stages of the work some investigators thought there was a considerable majority of male vines among seedlings of these grapes but we think this can be explained through the fact that among seedlings, a large percentage will blossom the third year from seed. The males, on the average, are more vigorous in growth and therefore a larger percentage of them will flower the first year the lot reaches the bearing age, than will the females. Therefore if we make our counts the third year from seeds, a small percentage of the female vines will not have come into blossom, and we will thus get an excess of males. But if the count for the sexes are made after all the vines reach the flowering age, the sexes will be approximately equal in number.

INHERITANCE OF COLOR CHARACTER IN CROSSES.

The color of the tendrils, internodes, and the new tender growth serve well as an indication of the color of the fruit. Vines having red or reddish green tendrils bear black or reddish black grapes, while those with green tendrils, internodes and new growth, produce light or amber colored fruit, as the Scuppernong. Male vines fall into these two groups just as the females, except they bear no fruit, and serve well in predetermining the color of the fruit of their progeny. Out of more than a thousand bearing vines we find that the color of the tendrils and new growth invariably corresponds to the color of the fruit—green tendrils and new growth giving light fruit, and dark or reddish colored tendrils and new growth giving black or reddish black fruit. In all crosses black is dominant and white or light a pure recessive.

The few crosses which follow are indicative of the inheritance of some of the color characters above mentioned:

	Color of vine
Scuppernong X light male No. 1	35 light 0 dark
Scuppernong X light male No. 2	27 light 0 dark
Scuppernong X dark male No. 1	35 light 41 dark
Scuppernong X dark male No. 2	75 light 57 dark
Flowers X light male No. 1	0 light 54 dark
Flowers X dark male No. 1	0 light 45 dark

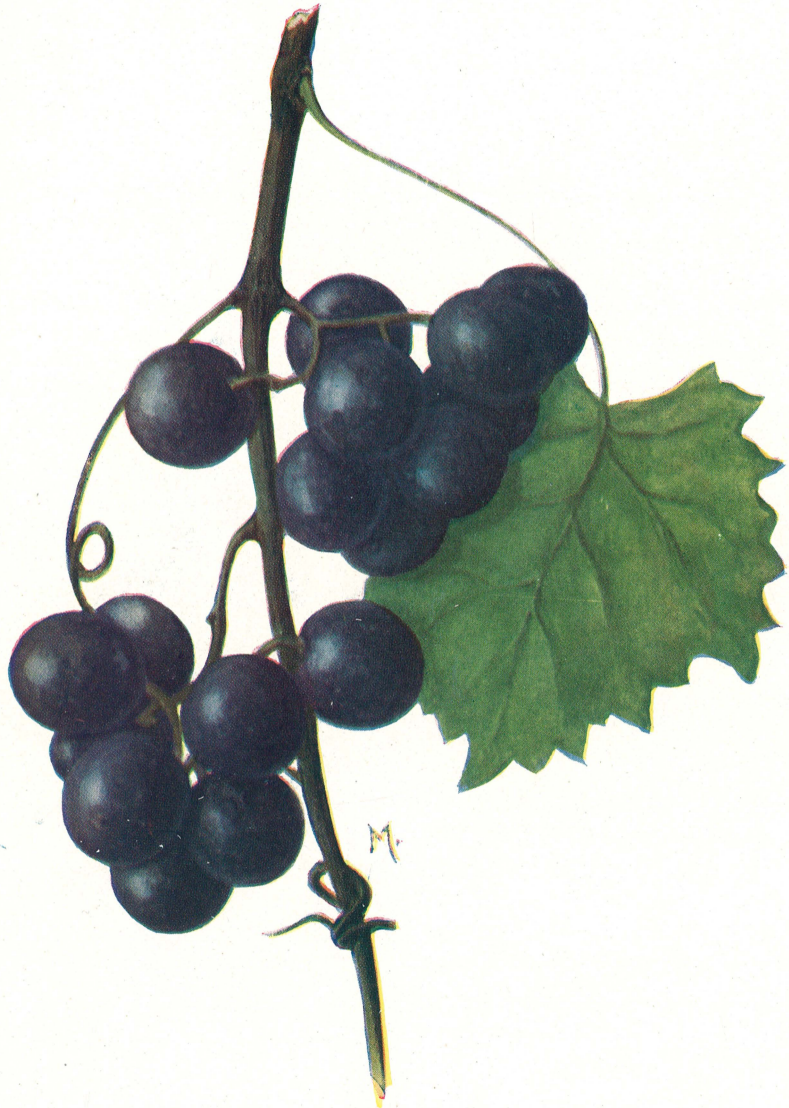


Fig. 3. Hunt.

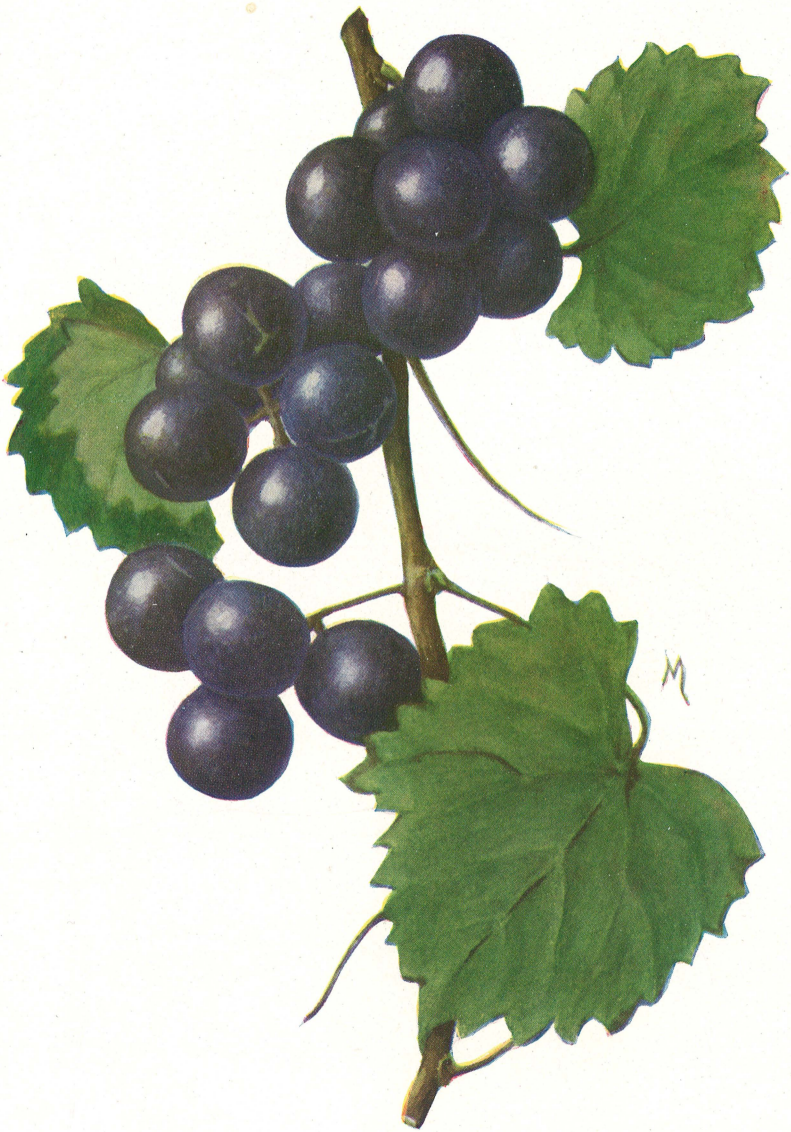


Fig. 4. Irene.

Fig. 5. Spalding.

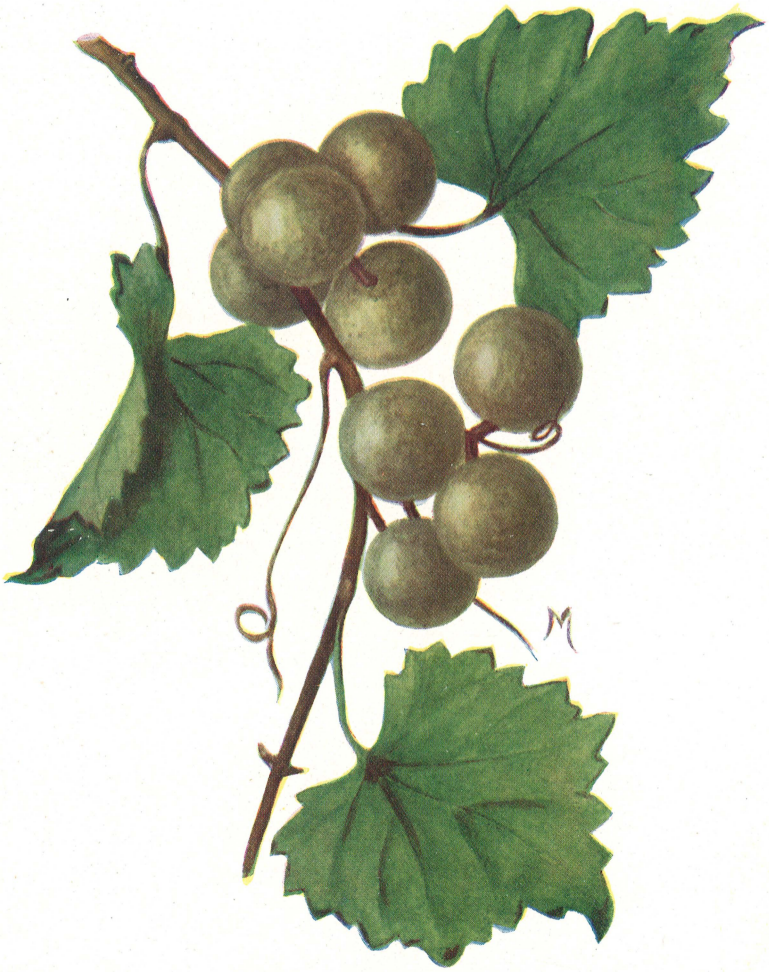


Fig. 6. Stuckey.

Reimer and Detjen, working along the same line found that black is dominant over red as well as white, and that pure black crossed with pure white gave all black progeny. They found further that heterozygus blacks crossed with pure whites gave progeny of both colors; and that heterozygus blacks and reds crossed with pure blacks gave all black progeny. From our work with the two colors, thus far, we offer the following formula:

(W = White B = Black and HR = Heterozygus Black)
WXW = W
WXB = B
BXB=B
WXHB=B & W.

With this knowledge in hand we are able to select the parent vines in such a way as to produce all light, all dark, or part light and part dark fruiting seedlings as we desire. For example, if we desire all light fruited seedlings, we bag the flower clusters of the Scuppernong and pollinate them with pollen from a male vine with green tendrils. These vines being self sterile, no emasculation is necessary.

TWO COLORS FROM SEEDS OF SAME GRAPE.

To ascertain whether or not the seeds of the same grape gave plants of the same color, the seeds of each single grape were planted separately. This was tried with Thomas Xdark male and with Scuppernong Xdark male. All the plants resulting from the dark male and Thomas cross were dark, but the seedlings from the dark male and the Scuppernong cross showed that seeds of the same grape may give plants of the same color or of different color as shown in the following table:

Grape No.	No. Plants	Light	Dark
1	2	1	1
2	2	1	1
3	2	0	2
4	1	1	0
5	2	0	2
6	1	0	1

This, of course, can be explained readily by the fact that the ovule for each seed is fertilized by a separate pollen grain. Thus it would be possible to obtain two or more hybrid plants, with different male parents from the same grape.

PREPOTENT MALES.

In studying the quality of the fruit from a number of the crosses, it was observed that certain males were prepotent in stamping good quality on the fruit of their progeny. The crosses best demonstrating this point were those made by crossing light male No. 1 and black No. 1 on the Flowers.

From the cross between the white male and Flowers eighty-six vines were grown—41 females and 45 males. Only one of the female vines produced fruit inferior in flavor to the Flowers, while all the remainder were superior. Thus showing the prepotency of the male.

Sixteen vines from the black male-Flowers cross were fruited and nine of them were females. Only one of these produced fruit that would equal the Flowers in flavor, while all of the others were decidedly inferior, and most of them worthless.

SELECTIONS AND NEW VARIETIES.

Out of the large number of crosses made, we very naturally eliminated a large majority soon after they came into bearing and the desired data recorded. In this work, however, we have also been on the lookout for selections with sufficient meritorious qualities to warrant their introduction as new varieties. Thus far, we have selected omis six vines from the total number of crosses made that we propose to introduce as new varieties. A considerable number of other promising vines, which reached the bearing age in 1918, are being kept under observation.

No effort is made to give detailed descriptions of these new varieties. Only a few points are recorded to note their chief characters. They are as follows:

1. HUNT: R. 19, V. 30, Cross between prepotent white male and Flowers. Vine vigorous, foliage healthy and medium to heavy; prolific, regular bearer; fruit, large, black, bunches well, hangs on well, cluster stems long, skin medium to thin, pulp medium, excellent flavor; ripens late August. We class this best of black varieties.

2. IRENE: R. 16, V. 27, Cross between black male and Thomas. Vine healthy, very prolific, vigorous grower; fruit large, attractive, lustrous black, skin medium, pulp and seeds

medium in size, quality good. Ripens 12 to 15 days behind Scuppernong and hangs on the vine in a plump, lustrous, edible condition from 5 to 7 weeks or until frost.

3. NOVEMBER: R. 6, V. 32, Cross between black male and Scuppernong. Vine vigorous, healthy, very prolific; fruit shade lighter than Scuppernong, occasionally tinged with red when full ripe, grows in clusters, hangs on well, size medium, quality only fair, and ripens very late, barely getting in before frost. Its extreme lateness, clustering habit, and prolificacy, make it worthy of propagation.

4. QUALITAS: R. 16, V. 36, Cross between black male and Thomas. Vine medium in vigor, healthy, very prolific; fruit medium to large, clusters medium, dull black, skin thin, pulp and seeds medium in size, very sweet and of excellent quality. Ripens from week to 10 days behind Thomas and Scuppernong, and remains hanging on the vine until about the 20th of October.

5. SPALDING: R. 19, V. 6, Cross between prepotent white male and Flowers. Vine vigorous, healthy, foliage slightly varigated, medium, very prolific and regular bearer; fruit, black, slightly smaller than that of Hunt, skin medium to thin, pulp medium to small; ripens slowly and good for use over long season; quality excellent. Ripens two weeks behind Hunt.

6. STUCKEY: R. 13, V. 16, Cross between black male and Scuppernong. Vine, only medium in vigor, prolific; foliage dark green, rather sparse, black rot leaf spots occasionally found; fruit medium to large, hangs on well, not attractive, of Scuppernong color heavily mottled with reddish bronze, thickness of skin medium, size of pulp and seeds medium, juicy, very sweet, and probably of best quality of any variety we have introduced. Ripens week to 10 days after Scuppernong.

VARIETY YIELDS.

Well rooted nursery vines of most varieties of these grapes will bear a few grapes the second season after planting. It will be the fourth or fifth year, however, before a fair harvest will be realized.

Vines in full bearing grown by the trellis system as subse-

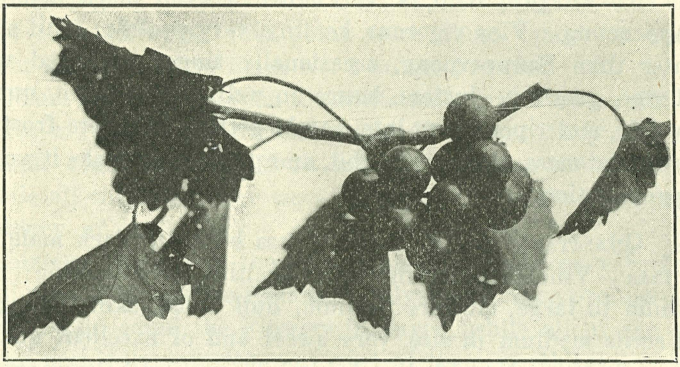


Fig. 7. November.

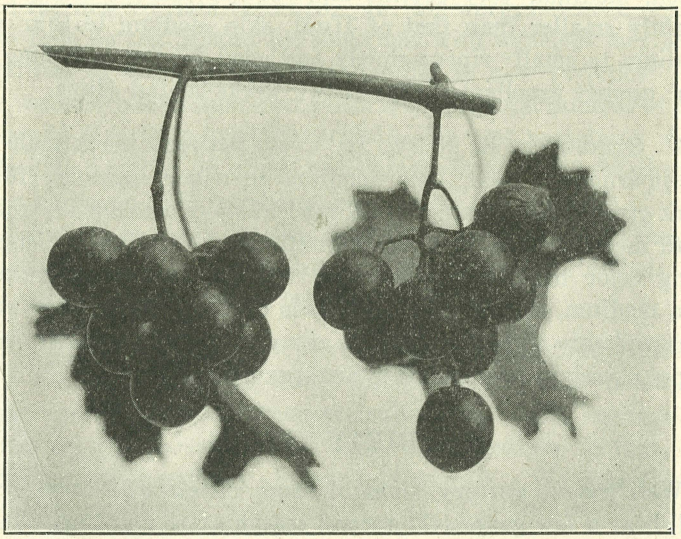


Fig. 8. R11.32. A promising seedling. Note length of cluster stems.

quently described should bear, on the average, from 50 to 60 pounds or about a bushel per year. The following table shows yields of some eight year old vines at this Station:

Variety	Lbs. of Grapes
Scuppernong	42
Thomas	60
LaSalle	30
San Manta	45
Labama	20
San Jacinta	42
Flowers	50

Varieties vary greatly from the above, from year to year, since any single variety which leads in yield one season may have a short crop the next.

The proximity to male vines also has some bearing upon the yield of a variety. Fruitful vines will usually bear more when only a few yards from a male than when they are several hundred yards away. For this reason growers are now advised to plant male vines about through the vineyard to serve as pollinators. One male vine to each 15 to 20 female vines should be sufficient.

STRAINS OF SCUPPERNONGS.

Growing at the Experiment Station are 180 Scuppernong vines more than twenty years old, which were put out without any special reference to the locality from which they came or any special type of fruit. Among these we find a range in size of fruit from an average diameter of one third of an inch for the smaller to three quarters for the larger. There is also a range in color from a light bronze to a greenish amber, and even a greater difference in that of flavor. Some of these vines produce fruit very inferior in quality. There is ample distinction between the fruit of the different vines to justify a division of this variety.

It was thought well to get more data on this point by growing other Scuppernong vines from different sections of the country. Consequently, in December, 1913, Scuppernong nursery vines were secured from the following places, and set under the same conditions, at this Station: Dennison, Tex.; Kittrill, N. C.; Augusta, Ga.; Rome, Ga.; Glen St. Mary, Fla.; and Experiment, Ga.

These vines, which started to bearing in 1916, showed similar, though less extreme variations than the older vines above referred to, showing that the nurserymen have used some care in weeding out the less desirable types.

METHODS OF PLANTING.

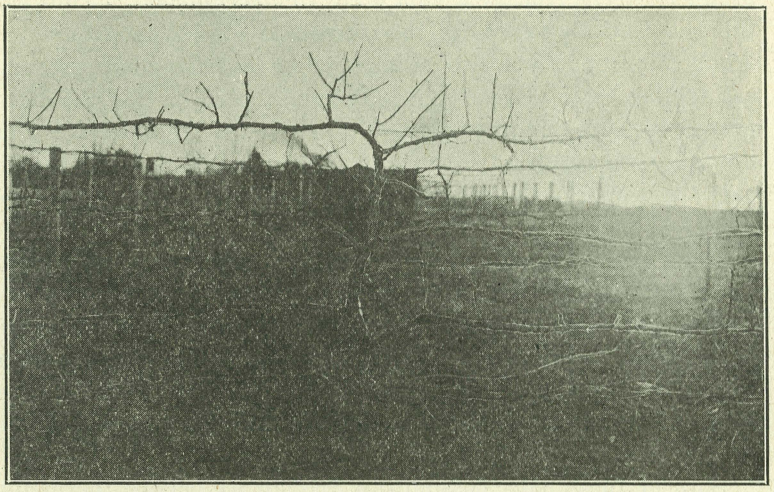
The Scuppernong and other varieties of this class of grapes have been grown almost entirely by the overhead or arbor system, until about ten years ago, when this phase of Scuppernong culture was taken up by some of the southern experiment stations.

In our work, we found that not only the yield could be increased by growing them on vertical trellises, but the vines were very much more easily pruned and that the harvesting was decidedly more conveniently and easily accomplished.

There should be a greater distance between the vines in the row, than between the rows. While the distance should vary with the vigor of the variety grown, we find that a satisfactory average is to place the vines from 16 to 18 feet apart in the row and the rows ten feet apart. This will allow sufficient room for cultivation and harvesting, and to plant one row of some intercultural crop between each two rows of grape vines.

Posts for the trellis should be 6½ feet high above the ground and set from 16 to 18 feet apart in the row so that one vine will occupy the space between each two posts. There should be four wires stretched on these posts to form supports for the vines. The bottom wire should be two feet above the ground and the others spaced 18 inches apart from this to the top of the post.

The first year the young vines are set to the vineyard, they may be supported by single stakes. But the trellises should be erected for the support of the second year's growth. The young vine should be allowed to send out two canes or arms, as it grows upwards, at each wire. These canes or arms are allowed to grow along the wires for 8 or 9 feet or until they meet those of the next vine in the row. At this point they are cut off when the pruning is done in the fall of the year.



A Thomas vine, showing method of pruning.

PRUNING.

For a long time it was thought that this class of grapes could not be successfully pruned, which probably accounts for the overhead method of training and allowing the vines unrestricted growth. Experience has taught us, however, that these vines can be rigidly pruned to their advantage if the pruning is done at the proper season. No one best date can be given for pruning, but it is preferable to do the pruning about the time of the first frost in the fall. If the vines are pruned much earlier than this there will be some injury from sun scald due to the unnatural defoliation before cold weather. If the pruning is delayed as late as mid-winter, the vines will be severely injured by excessive bleeding as soon as the weather begins to turn warm in the spring. This is especially evident where it becomes necessary to cut canes of considerable diameter. In fact, we should so train and prune the vines from the beginning that it should be very seldom, if ever, necessary to cut large canes. The renewal system is not very appliable to this class of grapes.

THE USES OF THE FRUIT.

One fundamental principle which applies to all horticultural crops is that *Any fruit which is consumed almost entirely by the*

producer never reaches a high stage of development. Thus far this is essentially true with the muscadine species of grapes. It is only the crop of commercial importance that demands sufficient capital and labor to develop it to the point of supplying the great masses of people in other sections and in other professions. For example, what would the orange industry have amounted to had only the people in the orange growing sections consumed the products?

These grapes do not bear shipping well and are decidedly impaired in flavor in five or six hours after they are harvested.

There are two avenues for developing the muscadine grape industry. One is the breeding of suitable varieties which may be shipped long distances and used as table grapes. The other is to grow larger quantities to be manufactured into unfermented grape juice.

Both of these have possibilities, though we believe the manufacture of unfermented grape juice gives promise of producing the quickest results.